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Methods of statistical design and inference were obtained for treatment effects under certain data-based allocation rules which are potentially useful when ethical concern is the major factor or when certain difficulties arise in recruiting patients for randomized clinical trials. Results were also obtained in related fields including sequential allocation, mixture models and survival analysis.

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TOPICS IN STATISTICAL ESTIMATION AND CONTROL

FINAL TECHNICAL REPORT

Herbert Robbins and Cun-Hui Zhang

April 30, 1996

Rutgers University

1. Objectives.

In scientific experiments data are often biasedly allocated, sequentially collected, indirectly observed, perturbed or censored by other variables; moreover, the response variables are often stochastically associated with other input variables. One wants to develop statistical models and methodologies for prediction of future responses at new inputs. The focus of the project was on the fields of biased allocation design, sequential analysis, empirical Bayes methods, and survival analysis. Specifically, the project was to develop statistical designs and inferences to address certain issues arising in clinical trials and sequential error detection.

2. Summary of Major Results.

Building upon their earlier papers, Robbins and Zhang (1991) developed methods of statistical inference for treatment effects under certain data-based allocation rules which are potentially useful when ethical concern is the major factor or when certain difficulties arise in recruiting patients for randomized clinical trials. Specifically, the paper provides methods for the estimation of the superiority of a drug to a placebo when all and only those patients at risk are treated with the drug. Robbins (1993) obtained consistent estimators in a totally non-parametric setting. Li and Zhang (1992) developed simple asymptotically optimal allocation procedures in the case where each

experiment has two possible outcomes. Zhang (1992) developed estimates for the distributions of latent variables or prior distribution, which achieve the optimal rate of convergence. Vardi and Zhang (1992), Gu and Zhang (1993), and Tsai and Zhang (1995) proved the asymptotic normality of non-parametric maximum likelihood and self-consistent estimates when data are subject to length sampling bias, double censoring from both the right- and left-hand sides, or interval truncation.

3. Graduate Student Research. Youping Huang, Xin Li, Zhaohai Li, Donghui Zhang, and Lingzhi Zhou completed their Ph.D. dissertations under the supervision of the principal investigators.

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